

# **FUTURE (PROPOSED) FOREST SERVICE IMAGE PROCESSING TECHNOLOGY**

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## **Introduction (Forest Service)**

The objective of the national image processing procurement is to provide a standard capability to all field level users in the Forest Service and provide consistent products from remote sensing data and other raster formats.

The combination of remotely sensed data, image processing, and GIS plays an important role in creating and maintaining GIS Core Data. Many of the GIS Core Data layers are derived from remotely sensed data. Digital imagery, as many of you know, can be used as back-drops for GIS data. This procurement is designed to make the manipulation of remotely sensed data and other raster data easier.

The proposed image processing system will be offered at two levels: basic and advanced. The basic system is an introductory level system designed for users with limited knowledge of remote sensing and image processing. The basic system will run on high end servers. The proposed basic system will be configured to include national software support and maintenance for the life of the contract. This will ensure consistent and standard application support, training, and data exchange throughout the Forest Service in an efficient and cost effective manner. Procurement of the basic system along with software maintenance and support is proposed to be funded as national software.

The proposed advanced system is designed for users with a higher skill level in remote sensing who require additional image processing tools. The advanced system is designed to meet the needs of higher end applications using large volume data sets. The advanced system is configured for use with workstation equipment. The proposed advanced system would only be purchased and funded by those sites that require this capability. The software

maintenance and support for the advanced system is proposed, to be included in the basic system, national software..

A consolidated national image processing procurement will provide the field with maximum flexibility in using remote sensing technologies. The proposed software will also provide an array of tools to assist, enhance, and support GIS applications. This national image processing procurement is necessary to provide a consistent, standard approach to using remote sensing to produce GIS Core Data, products, and resource information to support Forest Plan revisions, Large Area Assessments, project level vegetation mapping, monitoring, and change detection efforts.

### **Proposed Remote Sensing/Image Processing Solution (IBM)**

The proposed Remote Sensing / Image Processing (RSIP) solution for the Forest Service featuring IBM hardware and ERDAS IMAGINE software is designed to meet the needs of all levels of remote sensing users within the Forest Service. The proposed solution will be fully integrated into the existing Forest Service infrastructure, both from a hardware and software point of view. Together the integrated GIS-RSIP tools will become critical to the success of future Forest Service projects. The proposed solution also provides for training and technical support related to all aspects of the RSIP solution.

The proposed RSIP solution is tailored to meet the needs of the basic and advanced users of remote sensing technology and is therefore described in terms of a "Basic RSIP Solution" and an "Advanced RSIP Solution". Each solution is broken down in a systematic and hierarchical manner into its component hardware and software.

The proposed "Basic RSIP Solution" is intended for use in a server-workstation environment and addresses the needs of users who have little or no experience with remote sensing technology. The solution features the IMAGINE Advantage software module running on high-end IBM servers (e.g., the RS/6000 Models 590, 595, 397, R-40, J-50). The *minimum* software requirements for the basic solution include 300 MB of free disk space on the server, a minimum of 240 MB of swap space and AIX 4.1.5 or higher. Depending on the nature of the workstation from where the Advantage application is launched (X-terminal, PC or 43P workstation) the memory requirement for each IMAGINE session varies from 96 MB for 8-bit adapters to 128 MB for 24-bit adapters. Potential RSIP servers include the RS/6000 models 390, 397, 590, 595, F-30, F-40, J-50 and R-40. 43Ps as well as PCs and X-terminals with memory upgrades, all qualify as "basic" RSIP workstations.

The proposed "Advanced RSIP Solution" is intended for use only in a high-end workstation environment, and addresses the needs of experienced remote sensing analysts and researchers. The advanced solution features the IMAGINE Professional software module as well as additional add-on modules (IMAGINE Vector Module and IMAGINE Developer's Toolkit) running locally on high-end RS/6000 43P RSIP workstations. The *minimum* software requirements for the advanced solution include 300 MB of free disk space on the server, a minimum of 240 MB of swap space and AIX 4.1.5 or higher. The minimum memory requirements for each IMAGINE session running on a 43P workstation (24-bit adapter) is 128 MB. "Advanced" RSIP workstations include the 43P, models 140 (single processor) and 240 (dual processor).

The proposed software training classes include Remote Sensing Overview, IMAGINE ADVANTAGE and Cartography with Map Composer for the basic user. The advanced user classes include IMAGINE PROFESSIONAL, Image Processing, GIS Integration and Spatial Modeling and Multispectral Classification.

Technical support has been proposed in two different flavors, namely Help Desk Support and Additional Technical Support. Help Desk Support includes Level 1 -Product Usage, Level 2 - Problem Determination and Level 3 -Problem Correction. Additional Technical Support has been proposed for sites requiring assistance with product installation, system and product application development, process flow optimization etc. Two levels of Additional Technical Support have been proposed, RSIP Support and Senior RSIP Support.

### **(Proposed) Image Processing Software Matures (ERDAS)**

In the last few years, remote sensing has matured as a key component of a complete GIS. It has gone from an esoteric technical activity to an integrated GIS activity. Since imagery is information, it is critical for maintaining accurate and up to date GIS databases. The proposed ERDAS IMAGINE and accompanying products provide an integrated environment for remote sensing and GIS. The combination of direct read, import/export capabilities and vector functions, make ERDAS IMAGINE an ideal tool for a seamless integration with existing ARC/INFO and ArcView environments.

Imagery has unique requirements that cannot be met by the classic GIS. The proposed ERDAS IMAGINE provides an integrated solution with the requisite tools for inputting and manipulating images from various sources while providing a seamless environment that integrates data from a non-image GIS. The proposed solution provides easy to use graphical tools and outputs to other GIS environments, printers and the web.

The proposed integrated solution provides two image processing packages, Basic and Advanced RSIP systems along with optional add-on modules.

The functional capabilities of the proposed Basic system (ERDAS IMAGINE Advantage) include native read raster DLL's, import and export, sophisticated viewing, simple classification (ISODATA), map composition and plotting, 3D surface visualization and surface generator. The proposed Advanced system (ERDAS IMAGINE Professional) includes additional functions such as advanced classification, model maker, RADAR analysis and add-on options such as the Vector Module (GUI based ESRI Arc/Info topological editing utilities, additional vector import and export) and the Developers' Toolkit. Other modules will become available as operating systems and hardware are upgraded.

#### Detailed Functional Highlights

### THE PROPOSED BASIC SYSTEM

#### Date Import - Highlight of IMAGE Formats

- Landsat TM
- Spot Pan and XS
- NOAA AVHRR
- Radarsat
- DOQ
- Generic Binary (BIL, BSQ, BIP, Tiled)
- GeoTIFF and TIFF
- JPEG
- ARC Interchange (.e00) to Arc Coverage
- ArcView SHAPE to Arc Coverage
- and More...

#### Data Export - Highlight of Raster Formats

- DOQ
- Generic Binary (BIL, BSQ, BIP, Tiled)
- GeoTIFF and TIFF
- JPEG
- and More...

#### Data Viewing - Functional Overview

- Direct Read of Several Image Formats
- Raster Overlay and Transparency (Visual Change Det.)
- Direct ARC/INFO Coverage Read and Display
- Vector Overlay and Styling
- Roam and Zoom
- Image Rotation

- Contrast Enhancement (Histogram Tools)
- Spatial Enhancement
- Position and Spectral Query
- Measurement Tools
- Vector Annotation Editing and Styling
- Automatic Polygon Growing
- Area of Interest (AOI) Definition
- Position and Spectral Query
- Thematic Image Attribute and Color Scheme Tools
- Tabular Data Storage and Manipulation
- Line of Sight Profiling
- Surface Visualization
- Saving and Retrieving Display Parameter Pointers
- Movie Sequence Creation (Time Sequence)

#### Direct Read of Image and Vector Formats

- AOI (\*.aoi)
- Annotation ( \*.ovr )
- ARC Coverage
- ARC/INFO BIL (.bil)
- Binary (BIL, BIP, BSQ, Tiled)
- ERDAS 7.x (\*.lan, \*.gis)
- ER Mapper (\*.ers)
- SGI FIT (\*.fit)
- JFIF(JPEG)
- GIF

#### Simple to Advanced Display

- All defaults or complete control

#### Raster Overlay and Transparency

- Visual Change Detection
- Direct ARC/INFO Coverage

#### Read and Display

- Vector Overlay and Styling
- Roam and Zoom
- Image Rotation
- Contrast Enhancement
- Spatial Enhancement
- Position and Spectral Query
- Measurement Tools
- Automatic Polygon Growing
- Thematic Data Attribute and Color Scheme Tools
- Tabular Data Storage and Manipulation

- Line of Sight Profiling
- Surface Visualization
- Saving and Retrieving Display Parameters
- Movie Sequence Creation

#### Data Preparation

- Functional Overview
- Geometric Correction
- Image Subset
- Image Mosaic
- Surface Interpolation
- Unsupervised Classification
- Image Creation

#### Image Cataloging

- Functional Overview
- Store Name and Path of all related Images in one project file
- Keep and view geographic footprint, band numbers, cell sizes and other image information
- Store ARC/INFO coverage backdrops at any detail level desired
- Locate georeferenced image footprints within an ARC/INFO vector map
- Select and display images from within the catalog
- Layer Information Tool

#### Image Interpretation

- Functional Categories (with selected functions highlighted)
- Spatial Enhancement (includes Resolution Merge)
- Radiometric Enhancement
- Spectral Enhancement (includes Principal Components, Tasseled Cap)
- Hyperspectral Tools
- Fourier Analysis
- Topographic Analysis (includes Slope, Aspect, Surfacing)
- GIS Analysis (includes Perimeter Calculations, Buffer Zone Growth, and Zonal ARC At tribute Calculations)
- Utilities ( includes Subset Function and Mask Function )

#### Image and Vector Utilities

## **THE PROPOSED ADVANCED SYSTEM**

The proposed Advanced system includes features mentioned previously in the proposed Basic system along with the following;

- **Advanced Classification - Supervised and Unsupervised**
- **Model Maker - Graphical flow chart interface for creating or combining image and  
vector modeling functions**
- **RADAR Analysis - Correction and enhancement functions specific to  
RADAR**

### **Summary**

This partnership with IBM proposes two levels of image processing technology to meet the needs of the Forest Service. Future capabilities such as Radar Mapping System, Ortho Radar, Ortho Max, Sub Pixel Classifier could be proposed at a later date. The proposed RSIP solutions provide for a full range of Geographic Imaging tools that are link with ESRI products, the Forest Service national GIS.